CORRES. CONTROL
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DOE ORDER #

96-RF 01658

DIST.	LTR	ENC
BENSUSSEN, STAN		
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VOORHEIS, GARY		
WALLER, CAL		
Hedahl, T. G.	X	X
Boyd, Russ		
Detamore, Drew		
Dorr, Kent		
Hahn, Steve	X	X
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Lahoud, Russ		
Potter, Gary		
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CORRES.CONTROL	X	X
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TGH

ORIG. & TYPIST INITIALS:
SJH :bag

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KAISER•HILL
COMPANY

March 14, 1996

96-RF-01658

Jessie M. Roberson
ES&H Program Assessment
DOE, RFFO

Attn: David George

RESPONSES TO DEPARTMENT OF ENERGY COMMENTS ON THE DRAFT RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 3 OFFSITE AREAS - TGH-053-96

Enclosed are three (3) copies of the "Responses to Department of Energy Comments on the Draft RCRA Facility Investigation/Remedial Investigation Report for Operable Unit 3." These comment responses are expected to resolve all outstanding concerns expressed by the Department of Energy/Rocky Flats Field Office and will be incorporated into the Final Report.

Please contact Stephen Hahn at extension 9888 if you have any questions.

Tim G Hedahl

T. G. Hedahl, Director
ER/WM&I Operations

SJH:bag

Enclosure:
As Stated

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Responses to Department of Energy Comments on the Draft RCRA Facility Investigation/Remedial Investigation Report for Operable Unit 3

This document provides responses to formal comments from the Department of Energy Rocky Flats Field Office (DOE/RFFO) regarding the Draft RCRA Facility Investigation/Remedial Investigation Report for Operable Unit 3, Offsite Areas. Each comment received from DOE/RFFO is presented below in **BOLD** type followed by the corresponding response.

General Comments

Substantial improvement is shown in the document over the August 4, 1995 version. The readability of the document has greatly improved, particularly with the changes made to the format, editing and improvements in the logic flow. Editing has improved the document, yet many of the comments that would require more assessment have not been addressed.

This review identifies the comments that were not addressed (comment # underlined) along with new comments on the revised sections of the document. The comment location is updated to identify the current location within the document.

The soils discussion in Section 4, Nature and Extent of Contamination, has been expanded beyond the August draft document. The August document substituted a discussion of the COC selection process for a nature and extent evaluation. Although the soils discussion has been expanded to include a spatial assessment, the discussion of the sediments is still confined to a discussion of the COC selection process without a detailed discussion of nature and extent.

The application of GIS possibilities for enhancing the graphic presentation of the document information is still disappointing. The Hill contract contained a large amount of money to develop the GIS as a tool for developing the graphic presentation aspect of the Report (i.e. 3d projections, map overlays on aerial photos, simulated 3d cross-sections of the reservoirs, etc.) but nothing was developed beyond the usual 2d maps. The GIS was viewed and sold as a tool to enhance the public's understanding of the report.

Response: This issue was discussed with DOE on August 31, 1995. Due to inappropriate data sets and limited added value, the 3D projections, overlays, and graphics were eliminated from the report.

Specific Comments

1. **Table of Contents, pg. V**
   No table of contents are provided for the Appendices.
   Response: Table of contents will be added for the appendices.

2. **Page ES-4**
The references providing section numbers to additional information in the report should be more specific. For example, the last sentence in the last paragraph on page ES-4 references section 4.0 for additional information on rads in soils. A more specific reference for this topic is Section 4.3. Sending the reader to Section 4.0 on Nature and Extent, requires the reader to develop more understanding of the document than necessary. The intimidation level of the document is already quite high, thus minimizing the hunt for information will encourage more readers.

Response: Text changed to provide more complete reference.

Page ES-5
Last sentence in second paragraph should reference Sec. 4.4 Surface water Evaluation.

Response: Text changed to provide more complete reference.

Page ES-6
Last sentence in first paragraph should reference Sec. 4.5 and 6.0

Response: Text changed to provide more complete reference.

Page ES-6
Ground water section should have reference to Sec. 4.6.

Response: Text changed to provide more complete reference.

Page ES-7
Last sentence in first paragraph should reference Sec. 4.7 and 5.2 rather than 5.0.

Response: Text changed to provide more complete reference.

Page ES-7
The Ecological Sampling paragraph should reference the ERA summary in Sec. 6.2 and the detailed assessment in Appendix B.

Response: Text changed to provide more complete reference.

Page ES-8
The last sentence in the first paragraph should reference Sec. 4.3 rather than 4.0.

Response: Text changed to provide more complete reference.

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Page ES-8
First paragraph under the Baseline Risk Assessment, insert a statement that a summary of the HHRA can be found in Sec. 6.0 and Sec. 7.3 in the second to last sentence.

Response: Text changed to provide more complete reference.

3. **Page ES-2, last paragraph, 5th sentence**
Both the mean and max values for background Pu values should be reported.

Response: Text has been changed to report mean and max background Pu values.

4. **Page ES-5, first paragraph, 1st sentence**
Delete Coal Creek from the list of sample locations; no samples were collected from Coal Creek nor does the location appear on Figure 2-2.

Response: Text deleted.

5. **Page ES-5, last paragraph, 2nd to last sentence**
Include the new USGS, 1995 reference by Clow and Johncox along with DOE, 1994c. This reference should also be added to the bibliography.

Response: Reference has been added, and will be reflected in the bibliography.

6. **Pages ES-9, Baseline Risk Assessment results**
Too much dependence is placed on reporting only the CERCLA risk assessment results. Addressing the risk from OU 3 is one of the most valuable and important responsibilities of the RI Report, yet CERCLA requires reporting risk in terms of exponents to a public that does not understand exponents. One of the goals for the OU 3 RI is creating a vehicle for public involvement and education. Alternative methods of comparing risk need to be developed. The very large field of "Risk Communication" should be utilized to develop alternative comparisons of risk. An excellent start is made in Sec. A7.4. This Section should be expanded and given more prominence in the Report, especially in the ES. The purpose of the expanded ES was to reach the general public yet we still limit our risk assessment to the exponent terminology, which the public does not understand.

Response: Text has been changed to eliminate exponent notation, and will be revised to expand the Executive Summary.

7. **Page ES-10, first paragraph, 2nd to last paragraph**
The term <u>insignificant</u> should not be used to express risk to the public. This is a judgment that the public must evaluate. DOE's best position is to express risk as a comparison. We compare risk to number of cancer

incidence or background or other comparisons which can be quantitatively or qualitatively expressed. DOE should not be in the position of making judgments for the general public.

Response: Text has been changed.

SECTION 1.0 INTRODUCTION

8. **Page 1-1, 1st paragraph**
"OU 3 includes areas east of the site boundaries." Should be changed to "predominantly east" or "east, north and south" of the site boundary.

Response: Text changed to read:..."OU 3 includes areas **east, north, and south** of the site boundaries..."

9. **Page 1-6, Sec. 1.3.2, 1st paragraph**
Future and present tense used in the same sentence.

Response: Text revised.

10. **Page 1-6, Sec. 1.3.2., 3rd paragraph**
"The reservoir currently receives surface water runoff.." rather than "...previously received..." A transition sentence indicating the relative volumes of water that the reservoir receives from the two inputs should be included.

Response: The reservoir receives all of its influent from Coal Creek. Broomfield has sold its Clear Creek water rights. Text has been revised to reflect this fact.

11. **Page 1-10, first paragraph**
Jefferson County is listed as the owner of the land around Mower reservoir and should be changed to City of Westminster.

Response: Comment incorporated.

12. **Page 1-13, Table 1-1**
Citing only studies from the Past Remedy Report and Historical Information Summary and Preliminary Health Risk Assessment Report, published in 1991, miss several more recent references. Under soils the CSU work by Scott Webb is not included, The Citizens Environmental Sampling Committee report can be referenced as "in press." Under GWR the CSU Whicker student Thesis is not referenced nor the City of Broomfield sediment study, also the USGS report by Johncox can be referenced for all three reservoirs. Information from these reports should be integrated into this RI Report.

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Response: Broomfield, USGS, and the CESC reports will be referenced. The CSU work has not been made available to the public or to RMRS.

13. **Page 1-18, 4th paragraph**
Explain why 1993 data was used. It sounds like 1993 was chosen specifically to make the argument. Example - "Using 1993 as a typical year..."

Response: The 1993 perimeter sampler data will be replaced with the most current data and will be identified as such in the text.

SECTION 2.0 OU 3 FIELD INVESTIGATIONS

14. **Page 2-1, Section 2.0**
It should be reinforced that a complete description of the sampling rationale and strategy is presented in the Work Plan and what follows is only a brief summary.

Response: Comment incorporated.

15. **Page 2-1, Sec. 2.1, 2nd to last paragraph**
"...analyses requested..." should be changed to analyses performed.

Response: Comment incorporated

16. **Figure 2-4**
The 1983/84 core locations should be identified.

Response: Figure will be revised to indicate 1983/84 core locations

17. **Figure 2-5**
The symbol for the 1992 core locations appears in the key yet no symbol is found on the map. The SED 09092 (core) location appears twice in the reservoir.

Response: Figure 2-5 will be adjusted as noted.

18. **Page 2-32, last paragraph**
Add sentence that a graph of concentration with depth can be found in Appendix J.

Response: Comment incorporated.

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19. **Page 2-33, first bullet under Refinements to the Work Plan**
Two additional core samples were not included to verify Broomfield sampling. One of the added cores was to verify the Broomfield sampling in the Walnut Creek delta. The other shoreline core was unrelated to the Broomfield sampling. All the additional shoreline cores were added to better represent the long length of shoreline at the two large reservoirs. The text should distinguish between the shoreline cores which are only 6 inches deep and the reservoir cores that vary in depth in the deeper sections of the reservoir.

Response: The text is consistent with the "Comment Response to Draft Technical Memorandum No. 1" (submitted to DOE March 1, 1994), which states that a total of 5 vertical profile reservoir sediment samples were collected from Great Western Reservoir instead of 3 as originally proposed in the OU 3 Work Plan. It is also stated in this memorandum that the 2 additional core samples collected from Great Western Reservoir were collected to evaluate high plutonium levels detected by the City of Broomfield that occurred after the Work Plan was approved.

Distinction between nearshore cores, and reservoir cores is made in the text.

20. **Page 2-34, first paragraph after the bullets**
Change the number of reservoir cores taken at Standley to 4 and GWR to 5. This number of cores is verified by Figures 2-3 and 2-4.

Response: Comment incorporated.

21. **Page 2-42, first paragraph under Sec. 2.5.2, last sentence**
Add the following phrase to the sentence "...sites were selected to represent conditions encountered by recreational receptors..."

Response: Comment incorporated.

22. **Page 2-45, first paragraph under Sec. 2.6, last sentence**
Change to present tense by replacing "were" with "are."

Response: Comment incorporated.

SECTION 3.0 PHYSICAL CHARACTERISTICS OF OU 3

23. **Page 3-2, Figure 3-1**
The color quality of this figure is too poor to show the topographic features.

Response: Figure will be replaced with topographic map.

24. **Page 3-2, 2nd, 3rd and 4th paragraphs**
The text descriptions do not correspond with the Figure 3-2, 3-3 and 3-4 titles. The reference is missing from Figure 3-2. Are these population numbers correct? The sector 3 areas to the east and south east of the plant do not change through 2010 yet Table 3-1 numbers change. A key is needed for the Figures explaining that these numbers are populations and households.

Response: The Demography and Land Use section, including figures, will be updated and revised.

25. **Page 3-45, Table 3-14**
Is "Tail Marsh" the correct term in the legend?

Response: Text has been changed to read Tall Marsh.

SECTION 4.0 NATURE AND EXTENT OF CONTAMINATION

26. **Page 4-2, Section 4.1, paragraphs 3 & 4**
Paragraph 3 discusses rejected data as <u>un</u>usable for the RI evaluation yet paragraph 4 states "Any nonvalidated data ... were assumed to be usable and therefore were included in the data set for the RFI/RI evaluation."

Response: Text changed to read: Data that did not go through the validation process were assumed......

27. **Page 4-2, Sec. 4.1**
The 37% rejection of subsoil data is completely ignored. A discussion is needed.

Response: Much of the subsurface soil data was rejected by the data validators because of problems having to do with repeatability and precision. The rejected data were not used quantitatively for risk calculations. However, they were used for qualitative comparisons and nature and extent assessments. The text has been revised to reflect this.

28. **Page 4-1, Table 4-1, Data Item B-4, Summary of Results**
Defects should be changed to detects.

Response: Text has been revised.

29. **Page 4-8, Table 4-2**
No subsurface soil data is included nor the rejection numbers. It looks like we are trying to hide the high rejection numbers.

Response: Table 4-2 has been revised to show the subsurface soil data.

30. **Page 4-14, Section 4.3.1**
The Litaor manuscripts on Pu, Am and U that were written for this report with literature reviews, in-depth discussion of Kriging techniques, and extensive discussion of results are not included in the discussion. These manuscripts contain the detailed discussion expected in an RFI/RI Report, rather than the limited discussion and assessment found in the Health Physics article that is referenced. A large amount of money and over a year went into developing these assessments. The purpose of the published articles and the manuscripts are slightly different but both should be referenced and used in the assessment.

Response: Summaries of the results of these studies are included in the text. The manuscripts for these studies are included in their entirety in Appendix M.

31. **Page 4-16, 1st paragraph**
No reference is provided for the PPRG value of 3.43 pCi/g. The PPRG reference is not found in the bibliography yet is used several times in the document.

Response: Text changed to eliminate need for reference. Bibliography has also been updated with Programmatic Risk Based Preliminary Remediation Goals, U. S. DOE, RFETS, Final, Revision 3, August, 1995.

32. **Page 4-15, Spatial Distribution Sec.**
No uranium results are discussed. The discussion of U results should include maps and assessment. The OU 2 Kriging results finding no spatial pattern with uranium should be summarized, as the lack of OU 3 uranium contamination in OU 3 is the same argument that we use with metals. What happened to the spatial assessment of Am? We include Am as a COC yet no spatial assessment? Need to reference Litaor paper on Am distribution found in appendix M.

Response: Spatial distribution discussion has been changed to include Am. Uranium distribution is not discussed here because it was discussed in TM 4, and the spatial distribution argument was used to eliminate it as a COC. As discussed previously with DOE, the RI report will only focus on the contaminants identified by the agreed upon process. Discussions of other metals are not necessary, and reopen issues that had been previously resolved.

33. **Page 4-14, Sec. 4.3.1.**
Figure 4-5 from the August document has been dropped as recommended by DOE comment but the whole discussion of U isotopes in surface soils has also been dropped. No discussion of Am or U is found in the surface soil discussion. As recommended by DOE comment, a map showing the locations of the high U samples in relation to the RFETS would be more effective in making the distance argument. No reference to the OU 2 results for U isotopes in soils is made.

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Response: See response to comment number 32.

34. **Page 4-36, Sec. 4.3.2**
A discussion of this serious data validation problem is needed. What are the reasons for the rejections? These values are not used in the HHRA, thus rejecting 37% of the data outright seems severe without an assessment of why the data was rejected. If the data is being used for characterization purposes only, an assessment of the rejection codes and their importance should be evaluated. The same problem occurred in the trench data for OU 2, yet the data was still used in the assessment. This validation problem should be discussed up front in Section 4.1 and included in Table 4-1.

Response: Summary statistics were run only on the validated trench data because only data that has been documented as being acceptable by the independent data validators is used for the Human Health Risk Assessment. This represents 63% of the subsurface soils data set. The entire subsurface soil data set is used to qualitatively assess the nature and extent of contamination.

Data rejected by the data validation process is not necessarily unusable. However, because the tendency in the OU 3 Remedial Investigation and Human Health Risk Assessment is to err on the side of conservatism, data that could not be validated were not used for quantitative purposes.

Thirty seven percent of the subsurface soil data were rejected through the data validation process. The primary reason for this data being rejected was due to discrepancies between the contracted Minimum Detectable Activities (MDAs), and the instrument MDAs. These data do not appear to affect the qualitative data useability. When these data are compared with the subsurface soil data that have been accepted, there is little apparent qualitative difference. This comparison can be seen in Appendix H. After this comparison, it was determined that this data could be used for evaluating the nature and extent of contamination in the subsurface of OU 3.

The text will be revised to address this issue, however, this will not be characterized as a serious or significant problem.

An understanding of the depth distribution of Pu and Am is necessary to develop loading calculations. A question from the historical literature and recently raised by the Scott Webb work is the inventory of offsite Pu. The OU 3 RI investigation has the most extensive soil sampling data base and could add considerable information to this historical question.

Response: This issue was previously discussed with DOE. Pu inventory determination is not within the scope of this RFI/RI report. A proposal to provide an inventory determination has been submitted to DOE for approval and funding authorization. If approved, this information may be available for use outside the context of the RFI/RI.

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35. **Page 4-40, first paragraph**
This paragraph belongs in the front of Section 4.3.2 where distribution is discussed.

Response: Text has been revised to change the location of this paragraph.

36. **Page 4-42, 4-46 & 4-57, Tables 4-4, 4-5 & 4-6**
The format of these tables was appropriate when they appeared in TM 4 to evaluate specific analytes but the assessment is now on an IHSS basis. The IHSS's should be broken out to allow individual IHSS evaluations.

Response: These tables have been revised to separate out the analyses by IHSS.

37. **Page 4-44, sec. 4.5**
The USGS, Clow & Johncox 1995 article should be reviewed and extensively used to support the information throughout this section.

Response: Comment noted; Clow and Johncox cited where appropriate.

38. **Page 4-53, Data Summary for Surface Sediments**
A discussion of the uncertainties of comparison between stream sediments and reservoir sediments should be included. A direct comparison of values is a very conservative approach to understanding the concentrations. Explain the movement of sediment in streams vs. reservoirs. A simple concentration factor could be developed with non contaminant analytes and compared to metals that are a concern.

Response: The first paragraph text has been revised as follows:
In developing a benchmark data set for the reservoir sediments, it was found that benchmark data for plutonium and americium were not readily available. Therefore, stream sediment data from the Background Geochemical Characterization Report (DOE, 1993a) were used for a qualitative comparison with reservoir sediments. While the two data sets are not statistically comparable, they can be compared qualitatively as long as uncertainties in the comparison are noted.

The primary differences between the data sets are represented by the differences in their respective flow regimes. The streams represent a high energy environment, and the reservoirs represent a lower energy environment. Stated another way, the streams transport the sediments, and the reservoirs are the depocenters for the sediments. Contaminants such as plutonium have an affinity for fine clay particles and are transported along with the sediments. Stream sediments will have the tendency of being winnowed of the finer grained material, and this material along with its associated contaminant load will be concentrated in the reservoirs.

These differences represent the uncertainties in comparing the stream sediment background data, with the reservoir sediment data. The reservoir sediments may appear to have elevated contaminant levels relative to stream sediment values. This may be expected especially with insoluble constituents such as plutonium. By using the stream sediment data as a benchmark, the resulting comparison with reservoir sediments may be very conservative.

The comparison of reservoir sediments to background stream sediments is summarized below and in Table 4-5. Based on this comparison, activities of radionuclides in the OU 3 reservoir sediments were within background levels for all three reservoirs. The one exception is plutonium-239,-240, which was elevated above background levels in Great Western Reservoir.

This discussion is confined to justifying the selection of COCs and does not add to our understanding of the extent of contamination. A discussion of background and benchmark comparisons, maximum concentrations and mean concentrations does not explain the distribution of the contaminants. What spatial assessment was performed? Do we have a map of contaminant concentration isocontours? There are several simple computer programs that can quickly model the concentrations and provide us with an isocontour map. At least provide a large map with the Pu and Am concentrations for this section. The recent USGS Report 95-4126 contains a more extensive discussion of contaminant distribution.

Response: The referenced discussion is intended to be a discussion of the analytical results and summary of COC selection. The next section Spatial Analysis and Sediment Behavior discuss distribution of contaminants. This section has been expanded, and isocontour maps will be added.

Spatial Analysis and Sediment Behavior

Distribution of plutonium in the reservoir sediments is controlled by the natural processes at work within the reservoirs, and by the mechanisms which transported the contaminants. Contaminants entering the reservoirs as part of the stream sediment load are deposited near the stream inlet points. This depositional process is the same as the depositional processes responsible for the creation of deltas. The sediments being carried by the influent streams reach the lower energy environment of the reservoir and are deposited as they settle out of the water. This is illustrated in Figure X by the slightly higher plutonium activities measured in samples taken from the more recent sediments deposited near the Walnut Creek inlet of Great Western Reservoir. With time, wave action in conjunction with fluctuating reservoir levels, winnows out the finer grained sediments and gradually redeposits them in the deeper, lower energy portions of the reservoir. This phenomena is illustrated in Figure 4-9 where the higher Pu activities from historical releases are found within core samples taken from the deepest portions of Great Western Reservoir. These processes are most clearly evident in Great Western Reservoir where plutonium activities are higher than the other reservoirs, and the primary contaminant transport mechanism was the fluvial transport of Walnut Creek sediments resuspended during the pond re-engineering activities of the early 1970s.

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The primary transport mechanism for contaminants into Standley Lake was most likely aeolian. As a result, contaminants in Standley Lake were probably introduced in a more random distribution pattern and redistributed by the natural limnological processes as described above. The sediment sampling data presented on Figure Y shows the contaminant activities were not found near the reservoir influent points as in Great Western Reservoir, indicating that fluvial transport of contaminants to Standley Lake is not a primary transport mechanism. Mower Reservoir was also probably sourced primarily through aeolian transport but because of its small size, its natural mechanical processes have had little effect on its internal contaminant distribution. Plutonium activities remain evenly distributed throughout the reservoir's surficial sediments (Figure Z).

The mechanical processes at work within these reservoirs provide a natural attenuation of contaminants deposited near the shorelines. As the water levels in the reservoir undergo seasonal fluctuations, erosion due to wave action resuspends the finer particles which eventually settle out and are redeposited in the lower energy portions of the reservoirs where flow velocities can no longer support particle suspension. The nearshore sediments of the OU 3 reservoirs are at or near background levels with respect to plutonium and americium (Figure 4-?, 4-? and 4-?). These data further illustrate the effects of natural reservoir dynamics.

Spatial analysis of contaminants within reservoir sediments reflects the results of post depositional processes rather than the result of release and transport mechanisms. Because of the physical constraints of the reservoir, and the natural adsorption of plutonium onto the fine grained sediment material, a spatial analysis of sediment contaminants has the most utility for defining local variations in contaminant activities or concentrations. Spatial analysis provides more information when it is utilized from a sitewide perspective. This analysis is generally used to define trends in contaminant distribution and identify visual relationships between contaminants and sources. However, because of the differences in source areas and release mechanisms to the different reservoirs, and because of the reservoir dynamics once deposition has occurred, there are uncertainties in the spatial analysis.

If the reservoirs are considered in the context of their relationship to the Rocky Flats source areas, spatial analysis is useful to show the consistency of deposition in the reservoirs with deposition confirmed in the soils. Great Western Reservoir and Mower Reservoir are located approximately 2 miles from the 903 Pad source area. Standley Lake is approximately 3 miles from the 903 Pad. When the plutonium activities found in the sediment cores from these reservoirs are compared with the activities found in the soils, and with the reservoirs' relationship to the source area, some trends emerge. The subsurface sediments of Great Western Reservoir show the highest activities of plutonium for the three reservoirs. The maximum activity of 4.03 pCi/g and the mean of 0.93 pCi/g are reasonably consistent with the soil activity isocontours found in Figure 4-6. The activities measured in Mower Reservoir are somewhat lower (maximum 1.112 pCi/g, mean 0.21 pCi/g). Although these reservoirs are located nearly the same distance from the source area, the differences in their plutonium activities reflect their relationship to the 903 Pad plume, prevailing wind direction, and the presence of an additional fluvial source in Great Western Reservoir. The plutonium activities in Standley Lake are even more consistent with the isocontours of Figure 4-6. The maximum plutonium activity found in the subsurface sediment cores was 0.38 pCi/g and the mean was 0.07 pCi/g. These values in conjunction with the reservoir's relationship to the source areas and transport mechanisms, confirm our understanding of the nature and extent of contamination in OU 3.

Additional plots of sediment data can be found in Appendix I of this report. These plots include the metals analyses, and were used to show the lack of a trend that would indicate Rocky Flats as a potential source for these analytes. Further details of this analysis can be found in TM 4 (DOE, 1994d).

How does the data compare with previous studies, particularly the most recent Broomfield sampling and the extensive sampling by CSU? Have the estimates of contamination changed from some of the earlier studies? The USGS Report contains a discussion of historical studies.

Response: A discussion will be added to the text comparing the OU 3 sediment sampling results with the Broomfield sampling. The CSU work has not been made available to the public or RMRS.

How comfortable are we that the location of the contamination within the reservoir has not changed over time? The understanding that rads absorb to the clay particles with little solubility has lead to the conclusion that the rads are permanently tied up in the sediments (nature of contamination!). This immobility factor is key to the future Risk Management decisions for GWR. Evaluating the potential, or lack of, historical change and adding the factor of physical sediment movement within the reservoir will add valuable information to the risk management decisions for GWR. The USGS Report provides a good argument for immobilized Pu in the sediments.

Response: The above response regarding sediment behavior under comment 38 along with the response to comment 40 adequately addresses this comment.

39. **Page 4-53, last paragraph**
No separate discussion of nearshore sediment samples is included. The most logical current and/or future land use around each of the reservoirs is open space with exposed shoreline sediments. The questions of risk from exposed shoreline sediments will be very important during risk management decisions. Additionally the Work Plan identified the nearshore sediments as important to break out and sample separately. Inclusion of the data into the other reservoir numbers does not recognize the importance of the shoreline sediments from an exposure point of view. Shoreline sediments represent a separate category based on the highly fluctuating water level, thus greater surface exposure than a natural lake and relatively high erosion/resuspension potential. They

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should be assessed separately as they are not reservoir sediment covered by water and thus isolated, nor are they considered soil due to their higher erosion/resuspension potential.

Response: The discussion of nearshore sediments has been incorporated into the overall reservoir sediment spatial analysis discussion. Creating a separate analysis unnecessarily creates another exposure media. Reservoir sediments are not differentiated because in the risk assessment, exposure occurs whether the sediments are submerged or not. By using the maximum values from the surficial sediments, a worse case exposure scenario is established, and the relative risk of exposure to nearshore sediments is also established.

40. Page 4-56, Sec. 4.5.2. Subsurface Sediment Data Summary
As with the section on sediment grab samples, a discussion of nature and extent goes beyond a comparison of background and benchmark values and a listing of maximums and means. The nature of core sections implies an assessment of vertical distribution. A visual examination of the core profile is a much stronger argument that contamination events have not occurred than a comparison of mean values. Where is the comparison that was done during the TM 4 dispute?

How does the data compare with previous studies, particularly the 1983/84 sampling where the cores are co-located? An excellent comparison can be made by graphing the OU 3 concentration with depth profile and co-located Setlock profile on the same graph. Have the estimates of contamination changed from some of the earlier studies? A comparison of core profiles could be our most effective argument that the contamination is not moving. The recent USGS Report should be heavily cited for this comparison.

The metals distribution in the cores should be compared to soil concentrations. The issue of high background concentrations of Be and As compared to the PPRG values can be very effectively discussed with this core profile data.

No mention is made about the nearshore core samples.

Response: As per response to comment No. 32, discussion of metals distribution in the cores is not warranted. Metals were discussed and dismissed in TM 4 and its subsequent discussions. A discussion of nearshore core samples will be added.

The following text will be inserted beneath the 1st paragraph under the subheading Sediment Core Profiles:

The maximum plutonium-239, -240 and americium-241 activities were observed in most core samples at depths ranging from 13 to 31 inches below the water-sediment interface. The core profiles for plutonium-239, -240 in Great Western Reservoir (IHSS 199) show maximum activities in the reservoir at depths of approximately 18 to 20 inches. Figure __ illustrates the vertical distribution of plutonium and americium activity with depth observed in the 1992 OU 3 RFI/RI core sample SED09192 collected

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from Great Western Reservoir. The highest activity of plutonium-239, -240 in Great Western Reservoir (4.03 pCi/g) was measured at location SED09192 at a depth of approximately 18 inches. Figure 4-9 shows the depth profiles for activities of plutonium-239, -240 in core samples from Great Western Reservoir in relation to water depth and their location within the reservoir. As indicated on this figure, the highest levels of plutonium were found in the deeper areas of the reservoir (water depth at SED09192 is approximately 40 feet). This figure also illustrates that the highest activities are buried beneath the sediment surface; thus limiting potential for exposure.

Similarly, the data show that the highest levels of plutonium in Standley Lake and Mower Reservoir are buried beneath the sediment surface in the deepest portions of the reservoirs. The core profiles for plutonium-239, -240 in Standley Lake (IHSS 201) show maximum activities in the reservoir at a sediment depth interval of 18 to 32 inches. Figure __ shows the vertical distribution of plutonium and americium activity with depth observed in the 1992 OU 3 RFI/RI core sample SED08392 collected from Standley Lake. The maximum activity of plutonium-239, -240 (0.38 pCi/g) in subsurface sediments of Standley Lake was measured at location SED08392 at a depth of approximately 18 inches. The core profiles for Mower Reservoir (IHSS 202) show maximum activities in sediments at depths of approximately 4 to 8 inches. The maximum activity of plutonium-239, -240 in subsurface sediments of Mower Reservoir (1.11 pCi/g) was measured at location SED08992 at a depth of approximately 6 inches (Figure __).

At the time of sampling, Mower Reservoir was less than six feet deep. The gravity core sampler used in Standley Lake and Great Western Reservoir did not provide acceptable core material recovery in such shallow water, so a manually driven core sampler was used. Core recovery from the manual sampling method ranged from 9.5 to 22 inches, which was comparable to the gravity core sampling recoveries in Standley Lake and Great Western Reservoir.

Comparison of 1983/1984 to 1992 RFI/RI Data

For comparison of the subsurface sediment data collected during the 1983/1984 sampling event to the 1992 OU 3 RFI/RI data, four 1992 RFI/RI subsurface sediment sample sites were collocated with four 1983/1984 sediment core sample locations. The results of this comparison are also given in the U.S. Geological Survey report, "Characterization of Selected Radionuclides in Sediment and Surface Water in Standley Lake, Great Western Reservoir, and Mower Reservoir, Jefferson County, Colorado, 1992" (USGS, 1995). Two of the collocated samples were collected in Standley Lake and two were collected in Great Western Reservoir.

Activities of plutonium-239, -240 in the collocated core samples are plotted in relation to depth for each of the four sample locations in Figures ____. These data indicate that the trend of plutonium activity with respect to depth was consistent between the 1983/1984 data and 1992 RFI/RI data at all four sampling locations. The plutonium activities detected in the 1983/1984 samples were generally higher than those measured in the 1992 core samples. Plutonium activities measured from the 1992

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RFI/RI sampling are 10 to 30 percent less than activities reported in the 1983/1984 study (USGS, 1995). These differences may be a result of spatial variations in sediment and plutonium deposition.

A comparison of the 1983/1984 and 1992 RFI/RI subsurface sediment data also shows that the two sets of core profiles exhibit a prominent peak in activities of plutonium and americium at approximately the same interval when sedimentation rates are considered for each reservoir. Previous investigators have reported this prominent peak in plutonium and americium activities at similar depths (Hardy et.al., 1980_; Setlock, 1983_; Sackschewsky, 1985_; and Cohen et. al., 1990_) (USGS, 1995). The prominent peak in plutonium measured at approximately the same depth indicates that the contamination is not moving within the subsurface sediments over time. Figures _____ show essentially no vertical migration of plutonium in Standley Lake or Great Western Reservoir over the approximate 9-year period of time between sampling events. While inconclusive, a study by DOE (1994c) attempted to establish sedimentation rates for each reservoir, and use these rates to correlate the activity peaks in the sediments with Site releases in the 1969 to 1970 timeframe. Using sedimentation rates of 0.9 in/yr for Great Western Reservoir, 0.75 in/yr for Standley Lake, and 0.3 in/yr for Mower Reservoir, the study suggests that radionuclide contamination can be traced back to the corresponding years of release, whether due to aerial fallout from weapons testing in 1963, or releases from the 903 Pad clean up in 1969. Because the peak activities are still found in the sediments 23 years later, and little activity change with time is noted in the various studies and sampling events, the results of these various studies strongly suggest that plutonium is stable in the sediment environment, with no evidence of vertical migration.

41. **Page 4-60, 2nd paragraph**
The 4th sentence "The results of this study differ from the result of the OU 3 RI sampling effort." contradicts the last sentence "Qualitative comparisons suggest that the two data sets are comparable and consistent with one another and that the OU 3 data set is representative of the subsurface sediments of the reservoir." The Broomfield data is consistent with the OU 3 data with the exception of the high single data point. An additional core was added to the RI sampling plan at this point, in an attempt to duplicate the sample results. A discussion should be included on conclusions drawn from the additional core data.

Response: The 4th sentence of the 2nd paragraph will be deleted. In addition, the last sentence of the 2nd paragraph will state the following: "Qualitative comparisons suggest that the two data sets are comparable and consistent with one another, with the exception of the single elevated result, and that the OU 3 data set is representative of the subsurface sediments of the reservoir.

42. **Page 4-60, Sec. 4.5.3, Sediment Behavior Sec.**
If Pu is used as a tracer, the points made in this section can be shown very graphically. This section leaves too much responsibility on the reader to interpret the results. Requiring the reader to find the correct

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core profile in an appendix is not particularly effective in making this argument. Remember, the public does not have the same understanding of sediment behavior. Given the recent publicity during the Olympic festival activities at Standley, this information can be very effectively used during the public meeting presentations.

Response: This section has been revised. See response to comment 38.

Both GWR and Standley are irrigation supply reservoirs, thus go through a large seasonal fluctuation in water level. The shoreline sediment movement that occurs with this fluctuating water level should be discussed. This discussion will support the concern of shoreline users at the reservoirs.

Response: Effects of water level fluctuations are discussed in response to comment 38.

43. **Page 4-60, last paragraph**
Need to include discussion of high fluctuating water level and effect on exposed shoreline resuspension potential during winter.

Response: Effects of seasonal water level fluctuations are discussed in response to comment 38.

44. **Page 4-61, Sitewide Concentrations of Metals**
Delete "Sitewide" as this word has plant usage unrelated to OU 3.
2nd paragraph
The argument dealing with sources of water needs to be expanded. The strength of this argument is lost with such a limited discussion. This argument should also be combined with Sources of Water on page 4-62.

Response: "Sitewide" will be deleted. The entire discussion of sources of water under the subheading Sources of Water will be included in subsection Concentrations of Metals (following "It is important to note that..."). The subheading Sources of Water, and associated text, will subsequently be removed from the report.

45. **Page 4-61, Sediment Core Profiles, 2nd paragraph, first sentence**
Need reference on statement that Pu migration "...is not expected..." or explain the basis for expectation.
No discussion of Standley sediment core profiles is included. Need to explain core profile concentration peaks in SED08492 and SED08392. Need to provide discussion comparing data with 1983/84 data and soil isocontours.

Response: See response to comment 40.

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46. **Page 4-62, 2nd paragraph**
Why no comparable Figure 4-9 for Standley and Mower?

Response: Figure 4-9 was developed for Great Western Reservoir to illustrate the nature of contamination in the subsurface. This figure is relevant because the sediments of this reservoir contain COCs, and the future of GWR may be uncertain. Even though we discuss the relative levels of contamination in each of the reservoirs, the fact that the other reservoirs have no COCs, and the levels of contamination are so low (especially in Standley Lake), similar figures for these reservoirs would have little added value.

The last sentence states that shore core depths for Mower are due to poor field recoveries. Is this true? Mower has less sedimentation thus smaller core depths. Did we field document poor recoveries in Mower? A Mower core was sufficient for sediment dating and determining sedimentation rates.

Response: The following language will be added at the end of Sediment Core Profiles subsection: At the time of sampling, Mower Reservoir was less than six feet deep. The gravity core sampler used in Standley Lake and Great Western Reservoir did not provide acceptable core material recovery in such shallow water, so a manually driven core sampler was used. Core recovery from the manual sampling method ranged from 9.5 to 22 inches, which was comparable to the gravity core sampling recoveries in Standley Lake and Great Western Reservoir.

This information was taken from "Comment Response to Draft Technical Memorandum No. 1" submitted to DOE on March 1, 1994).

47. **Page 4-62, Age Dating of Sediment Cores**
Did we not learn anything of value from the age dating that was conducted? This section does not say anything about the result of the age dating that DOE conducted.

Response: The results of the age dating study were not as conclusive as we had hoped. Inconsistencies between the different historic data, the many potential variables affecting the assessment of the historic data, and the overall paucity of data, result in a minimum of useful information from this study. The RI report will contain a brief summary of the study and its conclusions supporting contaminant stability in the Subsurface Core Section (see language incorporated in last paragraph of response to comment No. 40.). The report will be referenced here but will not be included in Appendix K.

48. **Page 4-63, Sec. 4.5.5.**
Even though Pu falls out of the COC list for Standley and Mower due to the PRG screen, these reservoirs should be considered a special case in the nature and extent section and also in the HHRA. The maximum Standley Pu value is above the bench mark value and age dating shows a significant peak in the 903 pad time frame in sediment core 08392 (remaining cores

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are inconclusive). Standley is also within the 0.2 pCi/g soil isocontour line; thus arguing that Standley has no RFETS Pu contamination is very difficult. True the risk is negligible but the OU 3 risk communication effort would lose a great deal of credibility if Standley is just dropped from the assessment with the argument that it has no COC's. Additionally, the COC selection process is going to be very difficult to explain to the public, thus decreasing the public's trust in the investigation. Addressing the contamination in Standley and Mower directly rather than restricting the assessment to an argument why it has no COCs will gain DOE more credibility in listening and addressing the Public's concerns. The assessment in the HHRA does not require full calculations, just a discussion that the risk is less than GWR due to the extremely low concentrations.

Response: To address the contamination in Standley Lake and Mower Reservoir, the following text will be inserted in Section 4.5.2 beneath the 3rd paragraph under subsection Radionuclides:

Through the COC evaluation process, only plutonium-239, -240 was retained as a COC for Great Western Reservoir in the subsurface sediments, and plutonium levels were then compared with the PRGs. The only plausible PRG for subsurface sediments reflects exposure for a construction worker. This PRG (2,851 pCi/g) is well above the maximum activity of 4.03 pCi/g detected in subsurface sediments of Great Western Reservoir. Plutonium was retained as a COC in Great Western Reservoir only because there is some uncertainty regarding the future use of this reservoir. There is the possibility (though unlikely) that Great Western Reservoir may be drained and could be converted to residential, recreational, or commercial/industrial land uses. Thus, by retaining plutonium as a COC, the maximum exposure risk is evaluated for Great Western Reservoir. Details of the COC selection process for subsurface reservoir sediments can be found in TM 4 (DOE, 1994d).

Although the maximum activities for plutonium-239, -240 in Standley Lake and Mower Reservoir exceeded the maximum subsurface sediment benchmark activity, there is no reasonable exposure pathway associated with the subsurface sediments in these reservoirs. The maximum plutonium activities in subsurface sediments of Standley Lake were measured below the water-sediment interface from between 18 and 32 inches. The maximum plutonium activities measured in Mower Reservoir were at depths of approximately 4 to 8 inches. Because there are no plans to drain Standley Lake or Mower Reservoir for future development, there is no pathway for exposure of the contaminated subsurface sediments to a potential receptor (e.g., a construction worker). As such, the COC selection process eliminated plutonium as a COC in the subsurface sediments of Standley Lake and Mower Reservoir. Details of the COC selection process for subsurface reservoir sediments can be found in TM 4 (DOE, 1994d).

In addition, the text under subheading IHSS 201 (of Section 4.5.5) will be changed as follows:

In general, activities of radionuclides in Standley Lake sediments were comparable to those of background with the exception of plutonium-239, -240 in subsurface sediments. The maximum activity of plutonium-239, -240 in subsurface sediments (0.38 pCi/g) exceeded the literature maximum benchmark value (0.19 pCi/g). Concentrations of some metals...

...as PCOCs in the COC selection process. The COC selection process also eliminated plutonium**-239, -240 as a COC in subsurface sediments due to the lack of an exposure pathway from the subsurface sediments to a potential receptor.**

The text under subheading IHSS 202 will be changed as follows:

With the exception of plutonium-239, -240, all radionuclide activities detected in subsurface sediments of Mower Reservoir were comparable to those of background. The maximum activity of plutonium-239, -240 in subsurface sediments (1.11 pCi/g) exceeded the literature maximum benchmark value (0.19 pCi/g). However, the COC *selection process eliminated* plutonium as a COC in the subsurface sediments since there is no pathway for exposure of the contaminated sediments to a potential receptor. A detailed discussion of the COC evaluation process can be found in TM 4 (DOE, 1994d). All metals were found at background levels, except calcium in surface sediments and potassium in subsurface sediments. Calcium and potassium were eliminated as COCs because they are essential human nutrients. No analytes were identified as COCs for sediments in Mower Reservoir.

SECTION 5.0 CONTAMINANT FATE AND TRANSPORT

49. Page 5-9, FDM Sec.
Do to the extremely conservative requirements of the FDM modeling that was performed, it no longer presents a credible scenario. The results of this modeling should not be presented. A discussion should occur that explains the model limitations and why the modeling cannot be performed.
The comparison of the FDM results with the RAAMP sampler data needs a second look. If the FDM assumptions use an emissions rate from the extra disturbed runs and the daily replenishment of resuspendable soil which we know are not valid, then how could it legitimately compare to the RAAMP sampler data?

Response: The results of the FDM modeling will be removed from the report. A discussion will be added concerning the model limitations.

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SECTION 6.0 SUMMARY OF THE BASELINE RISK ASSESSMENT

50. **Page 6-2, AOC Sec.**
Need to explain the difference between the Iggy map and what is being done in the HHRA. Need to explain the difference between the AOC as defined by the HHRA and how it relates to the AOC defined in the Figure 4-6A map.

Response: The following will be added to the end of the Areas of Concern section:

The AOCs discussed here are based on the sampling results at discrete sampling locations. The AOCs were developed to assist in assessing exposure risk. This is consistent with the human health risk assessment methodology approved for use by EPA and CDPHE. The plutonium-239, -240 and americium -241 isoconcentration lines shown in Figures 4-6A and 4-6B, respectively, were derived using the same results from each discrete sampling location, but were developed to determine the nature and extent of contamination. The process of Kriging evaluates the relationship of each data point relative to the other data points in order to interpolate or estimate values in between the known data points. As a result, the Figures 4-6A and 4-6B are a representation or an interpretation of nature and extent of contamination. The AOCs developed for the HHRA are to facilitate a direct assessment of risk at a specific location.

51. **Page 6-5, Exposure Point Sec.**
Need more explanation of why the drained GWR scenario is being used. The text sounds as if this is what is actually going to happen. Need discussion of why we are evaluating the most conservative scenario as it is extremely unlikely that GWR will actually be drained. The demand for front range water and the value as a water storage reservoir will keep the reservoir as a reservoir.

Response: The following text will replace the text following "IHSS 200 Surficial Sediments-"

As stated above, the health risk evaluation for Great Western Reservoir was based on the assumption that a recreational and residential receptor has direct contact to the surface sediments of the reservoir. Because it is not possible to have direct contact to the surface sediments while the reservoir contains water, a hypothetical future use scenario was developed for the exposure-point calculations. This hypothetical scenario assumes that the reservoir is drained sometime in the future and the exposed area is developed for recreational and residential purposes. At that time, it is assumed an individual using the area for recreation or as a resident would contact the surface sediments. While this scenario is considered unlikely, it was used so that an upper bound on the risk could be determined. The exposure-point concentrations for these scenarios were estimated according to the following:

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52. Page 6-8, Summary of Estimated Risks
This information would be easier to comprehend in a Table or at least reference the summary tables in Sec. 7.

Response: A reference will be made to the appropriate Section 7.0 tables within each IHSS subsection.

53. Page 6-10 Comparison of COC-Related Risk to Risk from Background
This Section needs more prominence in the Report. Someone unable to follow exponential nomenclature, like the majority of the general public, needs an alternative comparison to understand the risk from OU 3. This Section needs to be expanded and placed in a prominent location in the Report. Other methods to compare the risk need to be developed and included in the Report under a section titled "Alternative Methods of Comparing Risk."

Response: The exponential nomenclature will be changed to be consistent with that used elsewhere in the report.

54. Page 6-10, last complete paragraph
The statements on background radiation exposures need references.

Response: The following reference will be used for average background radiation exposures:

Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR V, Committee on the Biological Effects of Ionizing Radiation, National Research Council, National Academy Press, 1990.

SECTION 7.0 SUMMARY OF RFI/RI REPORT

55. Page 7-1, Sec. 7.1.3
The statements that sediments in Standley and Mower are at background will be difficult to convince a skeptical public. The sediment core profiles in both Standley and Mower show very sharp peaks and they are both within the impact of the 903 pad as shown on Figure 4-6A.

Response: The following text will be inserted in Section 7.1.3 (also see response to DOE comment 48):

(after 1st sentence of 2nd paragraph)
The exception was plutonium-239, -240 which was detected above the maximum benchmark subsurface sediment value.

(1st sentence of 3rd paragraph)
All radionuclides, with the exception of plutonium-239, -240 in subsurface sediments were measured at background values. All metals were found...

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56. **Page 7-2, Section 7.1.5.**
Include a statement about the many years of RAAMP sampling results.

Response: A discussion will be added regarding the ambient air samplers maintained onsite and in the vicinity of Rocky Flats. The discussion will include sampling and analytical protocol information and a summary of the most current ambient air monitoring data.

SECTION 8.0 - REFERENCES

57. **Many of these references lack sufficient information that someone would need to find the document. For example, all citations between Litaor 1995 and Midwest Research Institute 1994, lack sufficient information to find and obtain the referenced document. The documents that are contained in the appendices should be noted in the bibliography.**

Response: Bibliography will be revised.

APPENDIX K

58. **This Sediment Age Dating Report contains many incorrect facts and has the potential to be quite embarrassing to DOE and contractors.**

Response: As stated in the response to comment 47, the Age Dating report will not be included with the RI report. DOE has repeatedly expressed their concern over this report. The report was finalized in October 1994 and will not be revised. The RI report will include it only in the bibliography.

59. **Introduction, first paragraph**
Environmental Technologies should not be referenced as no one has any idea who that is. The 3rd sentence should not begin with "we." The 4th sentence contains a reference to the OU 3 Report that is going to be very confusing to the readers.

Response: This Appendix will be deleted.

60. **Page 3, 3rd paragraph**
This report makes reference to the erroneous assumption of an offsite contaminant release in 1969. These statements contradict the statements in Section 4.5.3, Age Dating of Sediment Cores. There is a great deal of controversy surrounding speculation of offsite release contributions from this 1969 fire. Speculation that the reservoirs contain contamination from the fires, with no data to support this conclusion, contradicts several previous studies. No specific studies have ever been performed to assess this conclusion, thus a statement in this report that 1969 contamination gas been found is erroneous and potentially very embarrassing for DOE.

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Response: See response to comment number 59.

61. **Page 5, 1st paragraph, last sentence**
The statement that radionuclide ratio analysis will be performed in the OU 3 RI Report should be deleted.

Response: See response to comment number 59.

62. **Page 4, 2nd paragraph under Sec. 3.0, last sentence**
How the "criteria" referred to in this paragraph is used can not be determined.

Response: See response to comment number 59.

63. **Page 26, last paragraph**
The conclusion that comparing similar cores within a reservoir shows minimal mixing of the sediment should be incorporated into the Nature and Extent section of this RI Report.

Response: See response to comment number 59.

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